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No. 1994

# MOBILE ARTILLERY TARGETS, ACCESSORIES, AND SMOKE-BOMB OUTFITS

*SIX PLATES)*

FEBRUARY 27, 1908
REVISED JUNE 25, 1909
REVISED APRIL 2, 1910
REVISED JUNE 1, 1914
REVISED JULY 14, 1916
REVISED JUNE 5, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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UF856
T3U6
1917

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
*Washington, July 14, 1916.*

This manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
*Brigadier General, Chief of Ordnance.*



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UNIV. OF CALIFORNIA

# MOBILE ARTILLERY TARGETS AND ACCESSORIES.

(Pls. I to VI.)

The target system for mobile artillery includes five types of targets. Three of these, the "fixed wooden target," the "moving target," and the "flash target" are for service practice, and one type is for "simulated fire" only. The other type of target, "infantry flash," is used to represent infantry skirmish lines or machine-gun companies.

Any old type targets or target material in service may be utilized in its present condition or broken up and the parts utilized in the manufacture of the new types as may be most economical and convenient.

## THE FIXED WOODEN TARGETS.

These targets are for the purpose of enabling the mobile artillery troops to have firing practice in time of peace against fixed targets representing hostile guns and infantry.

The targets are rough wooden silhouettes cut out in such shape and painted so as to present the appearance of guns and caissons; machine guns; running, kneeling, and prone infantry. These targets are to be made up at the various posts or ranges by enlisted men from rough lumber and nails to be purchased in the vicinity and from drawings furnished the post ordnance officers by the ordnance officers of the respective departments. The paint and other hardware, except nails, will be furnished from Rock Island Arsenal in accordance with allowances shown on Plate II. These allowances have been computed to include enough material to make the number of targets of the various kinds as specified in columns headed "regimental" and "detached battalion allowances."

There is shown on Plate III the amounts of the various kinds and sizes of lumber and nails needed for constructing the allowance of the different targets. This table, it will be seen, has a double column under each commercial size of lumber and nails, and the figures in the columns show the number of board feet or number of pounds of nails the full allowance (regimental or battalion) of targets required. By the use of this table the purchasing officer can order the amount of lumber and nails needed for any set of targets or (by using the column totals) the amount necessary for the full allowance for all targets. The column totals have been increased by about 20 per cent to cover normal loss by defective lumber or by cutting or for additional figures. It will be seen that an allowance is made for 300 prone infantry targets for a regiment, or 200 for a detached battalion. If desired, this lumber may be made up into



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head figure targets or running infantry figure targets as needed for any special problem.

This table also shows the material needed for the prescribed number of target sleds and frames of the various types.

The bills for material purchased will be forwarded to the department ordnance officer for payment.

The wooden targets representing guns and caissons rest upon level ground or in a trench, as desired, and are supported upright by means of two wire guys 10 or 12 feet long and two 12-inch steel guy stakes, one in front of and one behind the target. The guys are attached to the target by hooks of $\frac{5}{16}$-inch steel wire which hook over the top of the target. This arrangement is shown in Plate I.

The smaller wooden running and kneeling figure targets are supported in place by a 1-inch iron ring in the middle of the back, which slips over a vertical stake driven into the ground as shown in Plate I. The small head figure and prone targets are held upright by a supporting cleat at the bottom, extending front and rear of target, at right angles to it, as shown on Plate I.

These wooden targets give a better idea of the number of effective hits obtained than the canvas targets heretofore issued. The holes can be plugged or marked with a red pencil and the targets can thus be retained in service in most cases for several target seasons.

### MOVING TARGETS.

Two types of moving targets are included in the present system, the "flank target" and the "advancing infantry or cavalry target."

The flank target is used to present the appearance of artillery moving across the field of fire. The target consists of a sled 12 feet long by 8 feet wide with runners of flat 3 by $\frac{1}{2}$ inch tire steel. Upon this sled is placed longitudinally a frame of wood upon which is fastened a sheet of canvas or cotton bearing painted figures of gun carriage and limber with crew and horses. Two sleds in tandem are required to represent a gun team and carriage target; the first sled carrying silhouettes of lead and swing horses and the rear sled carrying wheel horse, limber, and caisson, as is shown in Plate I.

The target frame shown on drawing 39–3–32 is for use with steel-frame targets exclusively, while the target frame shown on drawing 39–3–33 is for use with silhouettes exclusively.

### CONSTRUCTION OF FLANK TARGET SLED AND FRAMES.

This sled consists of a simple frame of rough 4 by 4 inch timbers. There are three cross sills 8 feet long, the ends of the middle cross sill resting on the top of the steel runner braces and the end sills being bolted directly to the upturned ends of the runners. The end sills carry at each of their ends an eyebolt for attaching the towing

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cable. The middle sill has stiffening blocks extending from its outer ends into the two center stringers of the target. These two center stringers, 4 by 4 inches and 12 feet long, are through-bolted to the three cross sills. The stringers are spaced 4 inches apart to afford a recess in which to rest the frame carrying the painted cloth target.

The runner braces, as shown on table of allowances, are furnished drilled and shaped. The runners are furnished drilled and bent to their 10-foot radius.

The target frames are constructed of rough 2 by 3 inch uprights and 1 by 4 inch stringers. The bottom stringer in each frame is double, one stringer on each side of the uprights, which makes the thickness at the bottom 4 inches to fit the 4-inch recess between the sled stringers. The frame is guyed to the sled in an upright position, as shown in Plate I, by galvanized fence wire furnished for the purpose.

The painted cloth figures are shown plotted on the drawing so that they can easily be reproduced at the post or range.

This sled is also used for carrying the advancing artillery target. This target is, however, placed transversely upon the center of the sled, as shown in Plate I.

### ADVANCING INFANTRY AND CAVALRY TARGETS.

The advancing infantry and cavalry target is designed to represent troops advancing by rushes. The sled for this target is shown on Plate I, and is 10 feet wide and 9 feet long. The cross sill, situated two-thirds of the distance from the front to the rear of the sled, is 14 feet long, and upon this sill is hinged a wooden frame carrying nine or more silhouettes of cloth representing running infantry. When the target is being towed, this frame is held upright by the towing cable, and the figures are therefore in full view; but when towing ceases and the target comes to a standstill, a pair of springs behind the upright frame pull the frame backward on its hinges to a horizontal position, thus masking the running figures, but at the same time raising to an upright position the small prone infantry figures placed on the bottom sill of the frame. In order to raise the frame to an upright position as the target is towed, two steel levers 6 feet long are fastened to the forward side of the frame carrying the target, but extending at right angles to the frame. When the frame is in its horizontal or masked position, these levers extend vertically upward. The two branches of the towing cable are fastened to the upper ends of these levers, and the first effect of the forward motion of the towing cable is to draw the upper end of these levers forward and down, thus raising the frame carrying the running figures to an upright position. By the time the frame has reached this upright position, the knots in each branch of the towing

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cable have reached the towing eye in the front sill of the target, through which they can not pass, consequently the target moves forward, the frame carrying the silhouettes in an upright position.

In order to stop the sled and target promptly when towing ceases, a brake is provided. This brake is hinged to the forward side of the rear sill on two eyebolts and is held up from contact with the ground when the target is in motion by being connected to the frame carying the upright silhouettes. When, however, the target stops and this frame is pulled backward into a horizontal position, it allows the forward point of the steel brake to drop to the ground and the brake is placed at such an angle that it digs into the ground and effectually and immediately stops the target.

### CONSTRUCTION OF ADVANCING TARGET SLED AND FRAMES.

This sled is somewhat different in construction from the flank target sled. The runners, braces, and end sills are similar to the other sled, but there are no center stringers. There are side stringers, however, of 2 by 3 inch rough pine and diagonal braces of 1 by 4 inch hickory. There is a long cross sill of 4 by 4 inches by 14 feet situated two-thirds of the distance from front to rear of sled, which sill carries the transversely placed target frame.

The runners and braces are furnished drilled and shaped.

The frame for this target is shown in the assembled position on Plate I. The uprights and braces are 2 by 3 inches; the stringers, 1 by 3 inches. The running-figure targets of cloth, painted, are strung along the top wire of the frame and tacked at the bottom; the prone figures of rough wood nailed face down on the lower of the two long stringers. The cut of assembled sled and frame in Plate I shows very clearly the arrangement of the levers, wire guys from frame to ends of levers, and also method of attaching wooden-head figure silhouettes on the stringer of the frame near the bottom of each cloth silhouette. These frames may be made either 24 feet long or 30 feet long, as desired. The table showing the lumber necessary for constructing this frame includes enough lumber for half the allowance in the shorter frame and half in the longer frame. Mounted figures, cloth, may be substituted for the running infantry figures if it is desired to represent advancing cavalry.

To get the proper adjustment of the knots in the cable so that the whole towing stress comes upon the eyes in the front sill of the sled and not upon the frame or spring chains, it is best to tie the knots before fastening the cable to the ends of the levers, then pass the cable through the lever ends and clamp the cable ends, adjusting so that when the knot bears on the rear of the towing eye the frame will just have arrived at a vertical position.

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The target springs are hooked in place on each end; if they are not of the proper strength to work the target frame properly their effect may be strengthened or weakened as desired by hooking their lower ends farther down or farther up on the spring chain.

Short runners of 0.625-inch round steel are placed on the back of each end upright so that when the frame is lying down on the sled in a horizontal position these runners rest on the ground and support the outer ends of the target frame.

This target is made to represent troops advancing by rushes by means of a special automatic clutch fastened to the branches of the cable just in front of the front sill of the sled. This clutch is essentially a hollow cylinder through which the towing cable can run freely. The cable carries at suitable intervals cylindrical wedges which are caught as they pass through the cylinder and drag the target along until a release stake (placed in the ground in the path of the target) is encountered, which trips the clutch and frees the wedge, the target and clutch stopping at the stake and waiting until the next wedge on the cable comes to it and carries it forward to the next release stake. As before explained, every time the target stops the running figures are masked and the prone figures are exposed.

The clutch-and-wedges arrangement, of course, starts and stops the target automatically, meanwhile allowing the cable to be drawn continuously, but if for any reason it is not desired to use the automatic arrangement the same effect can be obtained by stopping the cable limber intermittently, as desired.

*Automatic clutch.*—The clutch body is a a hollow bronze cylinder with two towing arms. It is fastened about 10 feet in front of the front sill of the sled to the two branches of the towing cables leading off of the target. The wedge on the cable is caught and held by the locking lever. When the clutch enters the clutch stake the operating lever passes under the stake's top, the trigger strikes the top of the stake, is forced backward, allows the locking lever to lift and release the wedge, which passes out of the clutch. Now, the target having stopped, the target frame is pulled backward by the tension springs behind it, and the branches of the cable therefore pull the clutch body backward. This forces the operating lever on the clutch backward against the stake top, causing the stake jaws to open, freeing the clutch so that when the next wedge on the cable comes along the clutch is free to be carried along by it, towing the target to the next clutch stake.

There are five short wedges and one long wedge with each clutch. The short wedges are to be strung along the one-fourth-inch steel towing cable and the long wedge at the end of the cable, it being



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heavier and designed to prevent the cable whipping, kinking, and catching on obstructions. The wedges are prevented from slipping along the cable by means of a steel pin in the rear end of the wedge. The cable passes once around this pin. A knot should be tied in the cable in the rear of the last wedge to prevent its slipping off. By this system the wedges can be located wherever desired on the cable. The length of time the target is masked depends upon the distance between the wedges.

Four clutch stakes are furnished with each clutch. In driving these stakes into the ground two points should be observed carefully, viz, the stake should be driven with the jaws open, striking the top of the stake body with a wooden maul to avoid burring, and care should be taken to drive the stakes deep enough so that the target sled will pass over them when they are open. The location of the stakes determines where the target stops and becomes masked.

*Automatic release.*—There is also furnished an automatic releasing device for use with either the flank or advancing target sled, the purpose of which is to automatically disconnect the target when the end of the course is reached.

### THE CABLE REEL.

The towing cable for the moving targets is intended to be drawn by a 3.2-inch limber, which has been modified by removing the chest and replacing by a double wooden reel mounted on a steel frame. When not in use the cable should be kept upon the reel.

An iron stake with ring is provided for use in connection with a snatch block where it is desired to change the direction of the towing cable, as in towing the advancing infantry or cavalry target.

### THE SIMULATED FIRE TARGETS.

These targets are, in shape and color, like the fixed wooden targets, but are made from cotton sheeting 80 inches wide, furnished by Rock Island Arsenal, and which are to be cut out, hemmed, and painted by enlisted men at the post or range.

Each of these targets, as will be seen from the drawing, has a 1-inch hem along its top and bottom edge. A piece of one-fourth-inch sash cord is passed through the bottom hem of the target (or the several targets, in the case of the prone infantry skirmish targets) and then returned through the top hem, leaving a few feet of cord on each extremity for tying to the guy stakes. The wooden spreaders, as shown by the drawing, are inserted so as to support the upper line of cord. Next the steel stakes with hook upper ends are hooked into the upper cord at the proper place and driven into the ground in the proper position. The two 12-inch steel guy stakes are driven into

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the ground a few feet to the right and left of the spot the targets are to occupy. The hooked steel stake having been driven to the proper depth, the upper and lower cords are now stretched tight and tied to the guy stakes on either side.

A target, or series of targets, having once been assembled in this manner, the cord has simply to be loosened from the guy stakes, the guy and hook stakes pulled from the ground, and the whole target, with spreaders and hooked stakes attached, may be rolled up, and be readily and quickly set up in any position desired.

### FLAGS.

Two patterns of flags are issued, as follows:

Danger flag (24 inches wide, 36 inches fly).

Made of scarlet serge, one end being bound with 2-inch olive-drab light cotton webbing. The binding has a 1-inch brass D ring sewed into each end for attaching flag to halyard.

Range flag (24 inches wide, 36 inches fly).

Made of white serge, one end being bound with 2-inch olive-drab light cotton webbing. The binding has a 1-inch brass D ring sewed into each end for attaching flag to halyard.

## Miniature Targets for Mobile Artillery.

For use in subcaliber work a system of miniature targets, one-tenth the size of the standard targets and made of cardboard, has been devised.

The following material comprises the allowance for each battery. Any material previously issued which has become unserviceable may be replaced by a requisition by the post ordnance officer for all batteries at the post:

10 miniature targets representing gun carriage and limber.
10 miniature targets representing caisson and limber.
20 miniature targets representing artillery horses (six-horse battery).
10 miniature targets representing gun carriage and caisson, shielded.
12 miniature targets representing machine gun.
50 miniature targets representing standing figure.
50 miniature targets representing kneeling figure.
50 miniature targets representing prone figures.
1 spool No. 48 white cotton seine twine (600 feet).
4 sleds with wedges.

## Infantry Flashes.

(Pls. V and VI.)

Infantry flashes are used with targets representing infantry skirmish lines and machine-gun companies when it is desired to accentuate the sudden appearance of such targets. They are designed to

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enable the mobile artillery troops to have practice in time of peace in the location of targets by means of reports and flashes simulating as nearly as practicable those produced by hostile machine-gun companies or infantry skirmish lines.

The apparatus consists essentially of a support, headplate, body, base plate, and three clamping bolts and nuts, the support being made of cast iron and the others of steel.

The headplate has 58 $\frac{5}{16}$-inch holes drilled through it. At each end is also drilled a hole for an electric primer No. 1. Two dowel pins are provided, one at each end, to center the holes in the headplate over those in the body. Three holes are tapped in the plate, into which are screwed the clamping bolts. Slots are cut in the plate at the primer holes, through which the wires of the electric primer are passed when the primer is in place. The first hole, next to the primer seat, at each end of the headplate is closed with a rivet. These holes act as a vent for the gases from the primer.

The body also has 58 $\frac{5}{16}$-inch holes drilled in it, corresponding to those in the headplate. These holes are not drilled entirely through the body, but communicate with the grooves in the bottom with smaller holes or vents. Three holes are bored through the body for the clamping bolts and two holes are drilled in the top for the dowel-pins in the headplate.

On the bottom of the body three longitudinal semicircular grooves are cut for the time fuze. Perpendicular to these 3 grooves 18 smaller cross grooves are cut. These serve as channels for the escape of the gases generated by the burning of the time fuze. At each end is the seat for the electric or friction primer and a vent leading from this to the top of the groove for the fuze.

The base plate has three grooves cut in its upper surface corresponding in shape and size with those in the body. No cross grooves are cut in the base plate. Three holes are bored through it for the clamping bolts.

The three clamping bolts are screwed in the headplate and locked in position by set screws to prevent their turning. Holes are bored through the clamping bolts at the place where they pass through the grooves in the body and base plate in order that the time fuze may pass through them. Nuts are screwed on the ends of the clamping bolts after assembling, thus holding the entire apparatus together.

The support has a cavity in the center into which the base plate is placed and three holes are bored through it to clear the nuts on the clamping bolts.

Each part of the apparatus has its serial number stamped on it to avoid confusion in assembling. Each apparatus has a separate number to avoid parts of one apparatus getting mixed with those of another.

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The components required in the preparation of infantry flashes are:

Powder measure to hold 9.3 grains small-arms smokless powder.
Composition measure to hold 1.5 grains slow-burning powder composition.
Assembling wrench.
Punch wrench.
Punch.
Hammer.
Funnel.
Brush.
Small-arms smokless powder.
Slow-burning powder composition.
Time fuze.
Wooden plugs.
Muslin.
No. 1 electric primer for axial and radial vents, or friction primers Nos. 1 or 2.

The apparatus is assembled in the following manner: Place it headplate down in the support. Unscrew the nuts and remove the base plate. Insert the time fuse in the grooves, pulling it through the holes in the clamping bolts. The ends of the time fuze should be cut off diagonally so that when it is in the assembled position in the grooves the cut ends will be directly under the vents leading from the electric primers. A disk of smokeless powder is placed under each end of the time fuze. The base plate is then replaced and the nuts tightened up. Before replacing the base plate care should be taken to make sure that the time fuze is in its proper position in the groove. The apparatus is now reversed in the support so that the headplate is on top. The punch is inserted in each of the holes and driven down with the hammer until its point cuts through the covering of the fuze and reaches the powder in its interior. The nuts on the punch should be so located that when the lower one touches the headplate the point has penetrated the fuze the required distance. After punching through all the holes, the distance from the point of the punch to the bottom of the lower nut should be measured to see that it had not changed during the operation. If for any reason this distance has become shorter the nuts should be adjusted to the proper place and the operation repeated.

After punching, 1.5 grains of slow-burning powder composition and 9.3 grains of smokeless powder is poured into each of the holes, with the aid of the measures and funnel. The slow-burning powder composition is poured in first. A wooden plug is then driven into each hole with the hammer until the top of the plug is flush with the top of the headplate. If any of the wooden plugs are hard to drive in, due to swelling from being exposed to moisture, they should not be driven in so far.

In each of the holes for the primers a piece of muslin is inserted so that it may be easily removed. This is to prevent any loose powder from falling out. The cracks between the base plate and the body

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and the grooves in the body should be well covered with wax or grease to keep out moisture during storage or transportation.

When the apparatus has been assembled as described, the charges will explode in sequence, starting at the primer and going down one side, up the center, and then down the other side. The duration of fire will be about two minutes.

When more rapid fire is desired, the following changes in loading should be made: After inserting the time fuze, before the base plate is put on, the covering of the fuze should be scraped off to expose the powder at places opposite the first cross groove at each end. These bare places are joined together by placing pieces of powder in the cross grooves. The operation of assembling is then completed as described before. When the primer is fired the flame besides burning down the fuze is also carried through the first cross groove, thus firing the fuze is three places and the charges are fired as the fuze burns from one end to the other, the duration of fire being about 45 seconds.

For an infantry skirmish line consisting of 100 target figures, three flashes are as a rule sufficient. They should be evenly distributed along the line and may be placed either a few paces in front or in back of it. Before putting the apparatus in place it should be knocked lightly against the support to force the slow burning powder composition down the vents so it comes in contact with the fuze. The piece of muslin will be removed from the desired primer hole and the primer inserted, its wires being drawn through the slot. The operating wires are then connected with the primer wires. The primer is exploded by use of a magneto exploder for the electric primer, or by a pull on a lanyard for the friction primer.

For machine gun targets, one flash is placed in front of each gun. This should be loaded to represent rapid fire.

Should the flash fail to function, first detach and remove the primer and put the muslin in its place. Loaded flashes which have failed to explode will be used again, using new primers. If the apparatus then fails to explode, remove the headplate and drive out the plugs. As soon as the headplate is removed, the powder charge should be poured out of the body and new charges and a new fuze put in if necessary. If wet, the apparatus should be thoroughly dried before reloading.

To clean the flash, remove the base plate and clean out the remains of the time fuze. The whole apparatus should then be given a thorough cleaning with the wire brush and the punch. Care should be taken to see that all vents are open and free from dirt and dust.

Before storing for considerable periods of time all unpainted parts should be well greased.

The apparatus complete weighs about 55 pounds.

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### SMOKE-BOMB OUTFIT.

Two types of smoke-bomb outfits have been developed for use in connection with mobile artillery target practice. One of these types, known as the grenade or sled type, has been developed at Frankford Arsenal and is capable of producing smoke puffs of considerable magnitude at any desired height up to about 40 feet. The other smoke-bomb outfit is known as the pole type, and was developed at the Field Artillery School of Fire. This device consists of a pole surmounted by a cup containing the smoke charge. No more of the grenade-type outfits will be manufactured, and the use of those in the service is discretionary, as provided in current target practice orders.

The object of these outfits is to produce a puff of smoke resembling a shrapnel burst at any desired point on the target range and at controllable heights above the ground.

### GRENADE TYPE.

The smoke-bomb grenade uses the .30-caliber model of 1898 rifle, with its sled support.

In general the operation is as follows: The grenade is prepared for firing by inserting its stem into the bore of the rifle and screwing onto its head the smoke charge. The rifle is prepared for firing by inserting into its breech in the usual manner a special blank .30-caliber cartridge. The rifle is fired by the small gray lanyard attached to the trigger and led about 50 feet away from the sled. The height at which the burst will occur is regulated by the length of the red lanyard attached to the smoke grenade at one end and to the sled or to a stake or stone at the other end. The grenade contains a percussion plunger, which, due to its inertia, moves forward and upward relative to the grenade body when the latter is suddenly retarded, as by the jerk of the red grenade lanyard when it has all paid out.

Twenty solid stems are furnished with each grenade outfit and each outfit contains two grenade bodies or casings and four bomb caps. The steel base of the grenade casing is drilled and tapped to receive the grenade stem. It is also provided with a transverse bore for the reception and attachment of the ¼-inch red grenade lanyard. The upper end is shouldered and threaded for attachment to the grenade casing. The steel grenade casing has a shouldered axial bore throughout its length for the reception of the percussion plunger holder and the plunger retaining spring. The spring embraces the plunger holder and exerts its thrust against a shoulder in the bore of the grenade casing and against the shoulder on the rear end of the plunger holder. The function of this spring is to retain the plunger holder at the rear or lower end of the plunger cavity until a strong retardation of the

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grenade occurs. The brass front closing plug or plunger guide of the grenade casing screws into a counterbored and threaded seat in the upper end of the grenade casing. This guide serves to close the plunger cavity. The upper face of the plunger guide is provided with two holes for engagement with the pin wrench for use in disassembly or reassembly. There is an axial hole through the plunger guide to receive the hardened steel firing pin of the plunger. The top of the steel bomb cap is slotted so as to receive a .38-caliber revolver primed cartridge. A locking lever is provided for holding the cartridge in place at the end of this slot so that the percussion cap of this cartridge shall be in line with the axis of the percussion plunger. The cartridge case is the same as that used for the .38-caliber service revolver. The function of this primed cartridge is to surely ignite the black powder contained within the tin envelope. The .38-caliber cartridge above referred to is to be inserted in the steel bomb cap with the fingers; the grenade does not have to be disassembled for this operation. The periphery of the bomb caps is turned taper and is smaller at the upper end than at the lower. This taper is provided so that the lower or open end of the charge can, can be forced upon it, furnishing a quick means of attachment. The charge can is of light tagger's tin of the cheapest construction. One hundred are provided with each grenade. It will hold 5 ounces of black saluting powder and still allow the bomb cap to be forced into its open end from three-eighths to one-half inch.

The pin wrench is for disassembling or assembling the plunger guide. This wrench is also provided with pins for unscrewing the bomb cap from the grenade casing, should the former ever be screwed on too tightly. A powder storage can of tin is provided. Its capacity is 5 pounds of black saluting powder. A hinged lid is provided and this lid is held shut by means of a spring so that the can can not be left open unintentionally.

To use this smoke-bomb grenade, a stem is inserted in the base of the grenade casing and screwed well home either by hand or by means of the pipe pliers which are issued with each outfit. The grenade is then loaded into the rifle without the bomb proper. The bomb proper is then made by filling the charge can of tin to within one-half inch of the top with black saluting powder. The grenade proper is then taken up and a .38-caliber cartridge inserted into it and the locking lever placed against it so as to hold the cartridge centrally in the grenade. Holding the grenade with the stem up, it is then lowered into the mouth of the tin charge can and pressed in with moderate pressure just as a cork is put into a bottle. The taper on the steel bomb cap should insure a secure enough fit so that the grenade may be handled as a unit after the tin charge can has been forced upon the taper of the steel bomb cap. While this grenade is being fired another grenade may be prepared.

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The sled support is strongly made of wood. It is designed to furnish means of transporting the apparatus and means for holding the rifle when firing smoke bombs. The sled proper has two 1¾-inch runners joined transversely by two 1⅛-inch transoms dovetailed to the runners. A one-half inch white sash-cord drawing bridle is furnished for pulling the sled from place to place. Between the runners and the transoms a seven-eighths inch wooden removable floor is provided. This forms a boxlike receptacle for carrying the equipment and supplies. The left-hand runner is reenforced with two strips of seven-eighths inch white pine in such a way as to form a socket or mortise for the reception of the rifle support proper. Each runner of the sled carries two hardwood dowels or pins about which the red grenade lanyard may be coiled for transportation or firing. The left-hand runner is provided with a hole through which the fixed end of the red grenade lanyard may be passed and anchored.

The rifle support is of seven-eighths inch white pine with two recessed cleats for the reception of the rifle. The rifle is attached to the support by two russet leather straps as shown. The rear of the rifle support carries two cleats, the lower one acting as a stop. These cleats are so spaced longitudinally as to just engage between the two transoms on the sled when the rifle support is laid horizontally on the sled.

The red grenade lanyard is of marine tiller rope. It is of braided construction, like sash cord, but has a flexible steel-wire core, giving great strength with lightness and small stretch. The diameter of this lanyard is ¼ inch, but it has sufficient strength to check the grenade at heights as low as 10 feet. One hundred feet of this lanyard is furnished with each outfit, but not more than 50 feet should be used between the anchor and the grenade. The trigger lanyard is of a gray color, of $\frac{3}{16}$-inch woven curtain cord. The sled bridle is of ½-inch white woven sash cord.

Sufficient black saluting powder in bulk to make up the annual allowance of 100 5-ounce smoke charges should be obtained by requisition from the nearest source of supply. This powder is ordinarily not issued in bulk with the apparatus proper. One hundred .38-caliber primed revolver cartridges are similarly furnished. The grenade stem can be used repeatedly, as it can be readily straightened by beating over a log or solid support, but the grenade must not be attached in this operation.

If the sled is used as an anchor rather than a strong stake or a stone, the supplies and implements should be removed from the sled box, as the sled is considerably jolted by checking the grenade in flight. At heights of burst as low as 20 feet the left-hand runner will be jerked up as much as 10 inches. For this reason, if there is no other available anchor than the sled, it is well to fill the box of the latter with stones or other heavy material.

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The following cautions may be of value:

(*a*) Sometimes the grenade is jerked back very close to the sled; therefore fire only with the trigger lanyard from a point well to the rear of the rifle.

(*b*) As the plunger is free in the grenade body, never carry the grenade by hand with the smoke bomb proper attached thereto; but if made up, carry them separately.

(*c*) If the red grenade lanyard is coiled on the sled dowels for firing, take pains to coil from the fixed end upward on the dowels. The lanyard may also be laid flat on the ground in front of the rifle if so desired.

(*d*) Never attempt to hold or go near the grenade lanyard while firing. To be tangled in it while firing would probably result in injury.

(*e*) When drawing the sled over rough terrain, put the rifle and rifle support in the traveling position, so as to avoid capsizing of the sled.

(*f*) Do not insert the .30-caliber blank cartridge into the chamber of the rifle until everything else is ready to fire.

(*g*) For very low bursts, wear and tear on the grenade, lanyard, and anchor will be minimized by slightly bending the stem so it will bind in the bore of the rifle slightly (enough to support the weight of the grenade), then insert only a portion of the stem, so as to give a lower initial velocity.

(*h*) Do not use any other blank cartridge than that furnished; otherwise excess pressure and a burst barrel may result.

Each grenade type smoke-bomb outfit consists of the following:

PERMANENT COMPONENTS.

2 grenade lanyards.
4 locking levers.
2 casings.
4 caps.
2 plunger guides.
2 bases.
2 plungers.
2 springs.
20 stems.
} For two grenades (100 shots).
1 wrench.
2 plunger holders.
1 pair 6-inch gas pliers.
1 powder can.
1 sled (complete), with rope and trigger lanyard.
1 caliber .30 rifle, model of 1898.

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POLE TYPE.

When fired at a height up to about 15 feet, the entire outfit is held by the operator. Beyond this height standards made from whatever material is available are placed vertically, a short distance apart, and a wire stretched across the tops. The removable staff is disassembled and the smoke bomb suspended under the wire by means of two pulleys and a lanyard.

The top pulley rides crosswise, thus permitting transverse movement of the smoke bomb. The bottom pulley through which the lanyard passes is fastened to the top pulley.

The one end of the lanyard consists of a short length of steel chain with a bag snap and is fastened to the bail which holds the smoke bomb. The short length of steel chain is necessary, as without it the lanyard would be destroyed by the exploding powder.

The other end of the lanyard may either be held by the operator after adjusting for the required height and transverse location or fastened to one of the standards.

The puff of smoke is produced by the ignition and burning of a small charge of large-grain black saluting powder contained in the steel cup. This smoke charge is ignited by means of a percussion cap. This percussion cap is placed on a percussion cap nipple, which is screwed into the side of the cup. The cap is fired by a sharp pull on the lanyard, which causes the firing arm to move in such a manner as to cause the flat face to impact with the percussion cap above referred to. The flame from this cap ignites the large-grain saluting powder contained in the steel cap. This saluting powder burns quietly and gives rise to no perceptible recoil, so that the pole may be held supported by the hands at any desired height.

The pole or staff is 1¼ inches in diameter and 11 feet 6 inches long. It is made of white ash. The lanyard is of $\frac{3}{16}$-inch braided curtain cord and 40 feet of it is provided with each pole apparatus. The lanyard fastened to chain is of $\frac{3}{16}$-inch braided curtain cord and 100 feet of it is provided with each pole apparatus. The powder storage can is made of tin and has a capacity for holding 5 pounds of black saluting powder. The powder storage can is provided with an attachment for automatically measuring out the required charge of 1.5 ounces of black saluting powder. This amount of powder is not sufficient to fill the steel cup and it is not necessary that more powder than that measured out should be used.

The black saluting powder is issued in bulk in 50-pound canisters. These canisters should be preserved and turned in.

No other powders than the black saluting powder issued should be used in this apparatus.

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Each pole type smoke bomb outfit consists of the following:

PERMANENT COMPONENTS.

1 staff.
1 fulcrum.
1 staff connection.
1 firing arm.
1 cup.
1 bail.
1 powder can.
1 percussion cap nipple.
1 lanyard 0.187 (3/16) inch diameter curtain cord 40 feet long.
1 lanyard 0.187 (3/16) inch diameter curtain cord 100 feet long.
2 galvanized awning pulleys for 0.187 (3/16) inch curtain cord.
1 bag snap with chain.

The annual allowance of ammunition for each type of smoke bomb outfit is given in the target-practice order.

## The Flash Target.

(Pl. IV.)

The apparatus hereinafter described has been designed to enable the mobile artillery troops to have practice in time of peace in the location of targets by means of reports and flashes simulating as nearly as practicable those produced by hostile guns in action.

It was found impracticable, within the necessary limits of cost and simplicity of design, to devise a system in which each flash would be accompanied by a report. The adopted plan contemplates having one report of about the loudness of a field gun to indicate that the hostile battery has come into action, and its general direction, followed by a succession of flashes at proper intervals to simulate the firing of the various guns.

The apparatus consists essentially of a cast-iron mortar and flash charges connected electrically by means of wires and switches with a push button, dry batteries, and telegraph relay. The details of the mortar and the switches are shown on Plate IV.

The charge to be used in the mortar is 6 ounces of black saluting powder. After inserting the powder charge a handful of damp clay or earth should be rammed in above it. This does not authorize filling the mortar with earth. The tamp should not be over 1 inch thick. The report of the mortar when so loaded is about equal in intensity to that of a field gun, and can readily be heard at distances at which field guns generally come into action.

Plate IV shows the arrangement and the electrical connections of the system when prepared for use. A thread is tied to one of the ears of the mortar, stretched across the muzzle, and passed through the other ear, and then secured to the contact blade of a switch

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screwed to a vertical stake in such a manner as to cause the thread to draw the contact blade into the right jaw against the action of the spring, the mortar being first tilted slightly toward the stake to insure tautness in the thread after it has been secured. The binding post serving as a pivot for the contact blade is connected to the dry batteries.

The binding post on the right jaw of the switch is connected to one of the leads of an electric primer in the vent of the mortar; the other lead of the primer is connected to the common wire from the telegraph relay. The current from the batteries is now free to pass through the electric primer of the mortar only. The binding post on the left jaw of the switch is connected to the pivot binding post of the switch for the first flash support.

The flash charges are arranged in sets of five, and are attached to wooden flash supports as shown on Plate III of the general outline and dimensions of a field-gun carriage, placed with the usual intervals between the guns of a battery in action. The first flash charge in each set of five is fired by an electric primer; the remaining flash charges are fired successively by means of slow-match material, which ignites the charges at intervals of about ten seconds.

A switch is provided with each support except the last one, the right jaw binding post being connected to the primer of the set of flash charges on the support to which the switch belongs, while the short jaw is connected to the pivot binding post of the switch for the next support, except in the case of the last switch. On this switch the short jaw is connected to one lead of the electric primer of the set of flash charges on the last silhouette. The other lead from this primer is connected with the common wire from the telegraph relay.

Plate IV shows the arrangement of these switches and the flash charges on the supports. The switches should be screwed to stakes driven in the ground near the supports.

A piece of thread, one end of which is attached to the contact blade of the switch, is passed through a staple on the support, in front of the first flash charge of each set, at which point it should be raised about a half inch by a twig, small stone, or staple to insure its being burned through by the flash. The end is then made fast just above this charge after it has been pulled taut enough to bring the contact blade into the long jaw of the switch which is connected to the lead of the electric primer of this set of flash charges.

With the apparatus arranged to begin practice, as shown by Plate IV, the current from the batteries must pass through the two-wire electric primer in the mortar, since the circuit between the contact blade of the mortar switch and the short jaw which is connected with the switch of the first set of flash charges is open.

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One charge ignites the electric primer in the mortar, firing the powder charge. The firing of this charge cuts the thread passing over the muzzle of the mortar and closes the circuit leading from the batteries to the electric primer of the first set of flash charges. The next charge ignites the latter electric primer, after which the four remaining flash charges in this set are ignited successively at ten-second intervals by the slow-match composition connecting them. The ignition of the first flash charge of this set cuts the thread leading to the contact blade of the switch pertaining to the first support and closes the circuit leading from the batteries to the electric primer of the second set of flash charges. Another charge ignites the primer and flash charges of this set and closes the circuit from the batteries to the electric primer of the third set of flash charges, and so on. It is obvious that the connections may be varied so as to ignite the flash charges on the supports in any other order than that shown on Plate IV if so desired.

The targets may be connected up with a single wire and ground return instead of the method described.

The push button and one set of batteries should be placed about 500 yards to one side of the line of fire and about opposite the position of the supports. The telegraph relay and other set of batteries should be placed close to the switch stake and protected during firing by fired shrapnel cases or any other suitable means.

One mobile artillery flash-target outfit is issued to each battalion of Field Artillery and each detached battery. The permanent components comprise the following articles:

1 telegraph relay.
* 8,500 feet single-buzzer wire, or 1,750 feet double-buzzer wire.
* 1 barrow reel.
1 mortar.
1 push button.

The annual allowance of expendable components comprises:

* 27 powder charges packed in individual tin cans.
* 30 electric primers for axial and radial vent.
* 150 sets of flash charges packed in individual tin cans.
* 1 pound double-pointed tacks.
* 3 spools of thread.
10 switches with wood screws.
* 1 switch stake.
* 10 flash supports.
4 dry batteries.

The telegraph relay, push button, and dry batteries are commercial articles.

* When these parts have been damaged beyond repair by fair wear and tear in service, or have been expended in repairs to other similar parts, they may be dropped from the return of the accountable officer with a certificate to that effect.

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The buzzer wire, which is No. 16 B. & S. gauge, is a commercial article known as annunciator wire, is twisted to form a double conductor 1,750 feet in length if single wire is used.

For the convenient handling of the wire a barrow reel is provided with each outfit. The twisted wire should be wound on this reel, which can then be readily handled by two men. When required for use, the wire can be payed off the reel. This wire should not be laid nor taken in by dragging it over the ground, but by moving the reel.

As many of the targets as may be considered desirable should be set up in rear of the flash supports to register the hits.

The mortar charge is 6 ounces of saluting powder. Twenty-seven of these charges for each outfit, in individual powder bags, are packed in individual tin cans. As previously stated, this charge, when tamped with damp clay or earth, well rammed, makes a good report.

The electric primer used for firing the mortar is the two-wire electric No. 1, shown on Plate III of Ordnance Department Pamphlet No. 1881, known as the "electric primer for axial and radial vents."

The flash charges are obtained from the Pain Manufacturing Co., or from other reliable manufacturers of fireworks. They are put up in sets of 5 each, in waterproof packages, each of which includes a two-wire electric primer for igniting the first charge of each set. The charges are connected with a slow-burning fuze composition and should be made fast to the wooden supports in about the position shown on Plate IV with the double-pointed tacks provided.

The outfit, as constituted above, is sufficient to represent a hostile battery in action, and to provide for 27 reports of the mortar and 750 flashes.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
*Washington, July 14, 1916.*

February 27, 1908.
Revised June 25, 1909.
Revised April 2, 1910.
Revised June 1, 1914.
Revised July 14, 1916.
Revised June 5, 1917.
FORM No. 1994.
Ed. June 5-17—2,000.

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